

PCT

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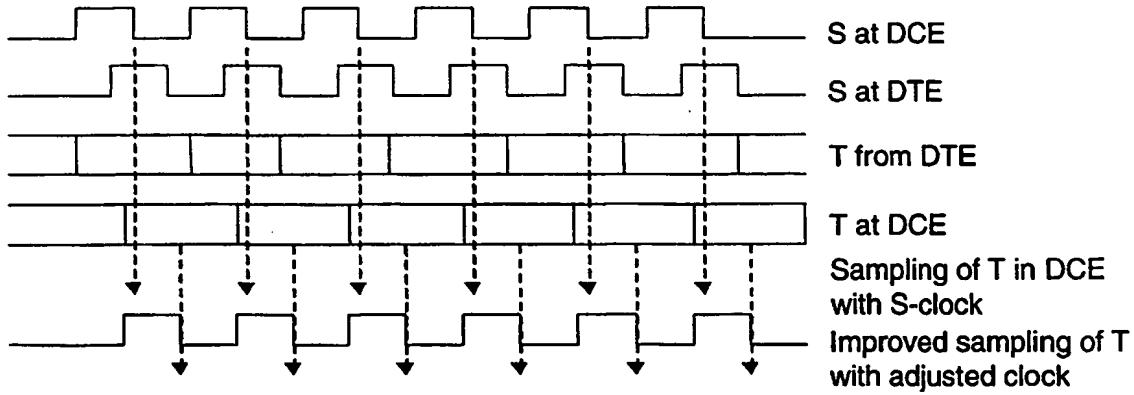


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: METHOD RELATED TO CLOCK DELAY COMPENSATION

### X.21 Interface (clock and data)



## (57) Abstract

The present invention concerns a method related to clock delay compensation, especially related to connection of data communication equipment (DCE) to modems and other types of data transmission equipment (DTE), the data signals having an arbitrarily delay through the cable in question, and the DCE comprising a detecting clock, and for the purpose of avoiding sampling of data close to the transitions, this problem is overcome by using the transition on the transmitted data (T-circuit on X.21) as a reference for adjusting (resetting) a counter which controls the data sampling, for thereby ensuring that data is always clocked in the middle of the symbol (data cell).

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**METHOD RELATED TO CLOCK DELAY COMPENSATION**Field of the invention

- 5 The present invention concerns a method related to clock delay compensation, especially related to connection of data communication equipment (DCE) to modems and other types of data transmission equipment (DTE).
- 10 The present invention also relates to data transmission interfaces.

More particularly, the present invention relates to a method as stated in the preamble of the enclosed patent  
15 claim 1.

Background of the invention

- THE PROBLEM AREA
- 20 For connection and data communication equipment (DCE) to modems and other types of data transmission equipment (DTE) there are standardised several interfaces. These interfaces define data and clocking as well as control lines. Typical interfaces mentioned are RS232 (V.24),  
25 V.35, V.36 and X.21. The electrical interfaces for the interface are defined in V.10, V.11 and V.28.

Basically, these interfaces were defined according to ITU rec. X21 which limits the bitrate to 64 kbit/s.  
30 With use of the electrical interfaces V.11 ranges of several hundreds of meters of cable can be used. The interface V.35, V.36 and X.21 define this electrical interface for clock and date.  
35

In connection with the use of this interface for bitrates higher than 64 kbit/s, by now up to 2 Mbit/s one problem has arised, caused by the pulse delay on a long cable becoming comparable with the period of the clock.

5

In the case of a codirectional interface, that is clock and data have the same source, the delay is not a problem, but in the case where a contradirectional interface is used, like the X.21 interface or use of DCE-clock 10 (114) on V.35/V.36, there will be a problem of detecting the data signal with the DCE-clock. This because the data signals have an arbitrarily unknown delay through the cable.

## 15 KNOWN SOLUTION

To overcome this problem, the DCEs are equipped with a manual option of changing the phase of the detecting clock, thus avoiding sampling of data close to the transitions. An extra not standardised X-circuit on the X.21 20 interface is also used.

## PROBLEMS WITH KNOWN SOLUTIONS

Problems with known solutions are that the cable delay is unknown and the manual selection of inverted or not inverted clock is done on the respective site installation 25 by trial. The X-circuit is not standardised and is by customers not recommended.

Further prior art

30

US 5 568 526 (Ferraiolo et al.) relates to a self-timed interface (STI) in which a clock signal clocks bit serial data onto a parallel, electrically conductive bus and the clock signal is transmitted on a separate line of the 35 bus. The received data on each line of the bus is individually phase aligned with the clock signal. The re-

ceived clock signal is used to define boundary edges of a data bit cell individually for each line, and the data on each line of the bus is individually phase adjusted so that, for example, a data transition position is in the 5 centre of the cell. Data are read into a buffer storage with the received clock and are read out with an internal clock in the interface.

EP 0 602 898-A1 (Kawada/Fujitsu Limited) relates to a 10 method and apparatus for synchronising transmission of modem. The phase difference between internal and external data/clock signals are equalised, by controlling the internal timing signal so that the measured phase difference will approach a reference phase difference.

15 EP 0 603 600-A3 (Klimek et al./Siemens Rolm Communications Inc.) relates to path delay compensation in an open-loop system, the signal paths being compensated by internal clocks in the units of the system. The compensation is based on a synchronising signal.

US 4 916 717 (Sackman, III et al.) relates to clock synchronisation of a master clock following data messages received from a remote data transmitter having the same 25 clock frequency, but which is phase shifted due to delays in the signal paths.

Further publications related to this technical field are NO patent applications 924247 (Coquerel/Institut Français 30 du Pétrole), 942171 (Hedberg/Ericsson), 961421 (Buhrgard/Ericsson) and 961454 (Buhrgard/Ericsson).

#### Objects of the invention

35 A main object of the present invention is to suggest a solution which automatically compensates for the cable

delay and makes sure that data is always clocked in the middle of the symbol.

Another object of the present invention is to present a  
5 method wherein existing equipment is utilised in a far more expedite manner.

Still another object of the present invention is to provide a method by which time delay compensation is independent of the length of the transmission cable.  
10

Brief summary of the invention

The above objects are achieved by a method as stated in  
15 the preamble, which according to the present invention is characterised by the features as stated in the characterising clause of the enclosed patent claim 1.

More specifically the present invention suggests to use  
20 the transition on the transmitted data (T-curcuit on X.21) as a reference for adjusting (resetting) a counter which controls the data sampling.

Further features and advantages of the present invention  
25 will appear from the following detailed description of embodiments, taken in conjunction with the enclosed drawings, as well as from the appending patent claims.

Disclosure of the drawings

30 Fig. 1 is a schematical diagram illustrated an example of a data transmission with related interfaces, wherein an embodiment of the present invention can be implemented.

35 Fig. 2 illustrates time diagrams related to transmitted data, signal element timing and received data, all in ac-

cordance with an appropriate embodiment of the present invention.

Detailed description of embodiments

5

With reference to Fig. 1 and Fig. 2 there will now in the following be described an example of how the method according to the present invention may be implemented.

- 10 As stated previously, the invention relates to a method which automatically compensates for the cable delay and makes sure that data is always clocked in the middle of the symbol.
- 15 The method uses the transition on the transmitted data (T-circuit on X.21) as a reference for adjusting (resetting) a counter which controls the data sampling.

20 The transmit data on the DCE-interface is delivered from the DTE with reference to the S-circuit (signal element timing) but with the mentioned cable delay. By clocking the data of the T-circuit into a buffer with the variable phase clock and clocking out with reference to the S-clock, error free operation is secured independent of delay.

25 ADVANTAGES

The described invention makes it possible to use the X.21 interface for high bit-rates on long cables. Installation work and operational uncertainties are eliminated and standard X.21 can be used.

BROADENING

The principle can be used for any synchronous interface with contra-directional timing.

## P a t e n t   c l a i m s

1. Method related to clock delay compensation, especially related to connection of data communication equipment (DCE) to modems and other types of data transmission equipment (DTE), the data signals having an arbitrarily delay through the cable in question, and the DCE comprising a detecting clock,  
characterised by using the transition on the transmitted data (T-circuit on X.21) as a reference for adjusting (resetting) a counter which controls the data sampling, for thereby ensuring that data is always clocked in the middle of the symbol (data cell).  
15 2. Method as claimed in claim 1,  
characterised in that the transmit data on the DCE-interface is delivered from the DTE with reference to the signal element timing circuit (S-circuit) but including the cable delay.  
20 3. Method as claimed in claim 1 or 2,  
characterised in that the transmitted data (T) of the T-circuit are clocked into a buffer with the variable phase clock, and are clocked out with reference to said signal element timing clock (S-clock).  
25

1/2

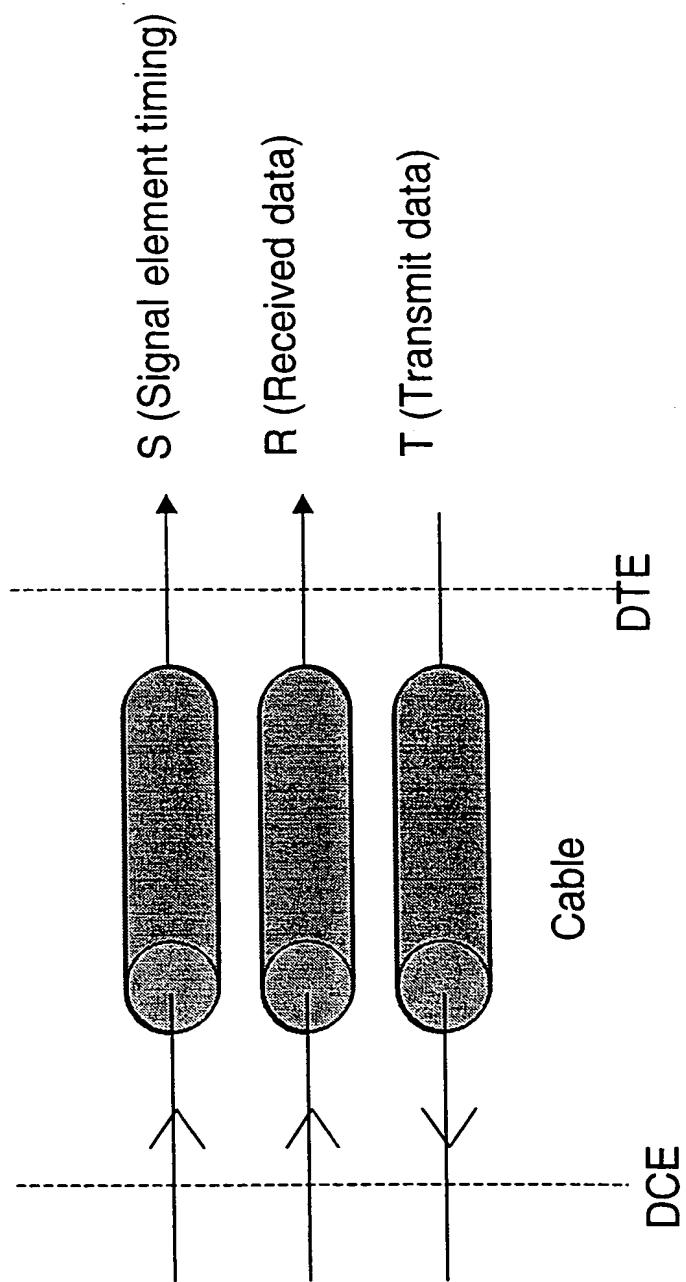
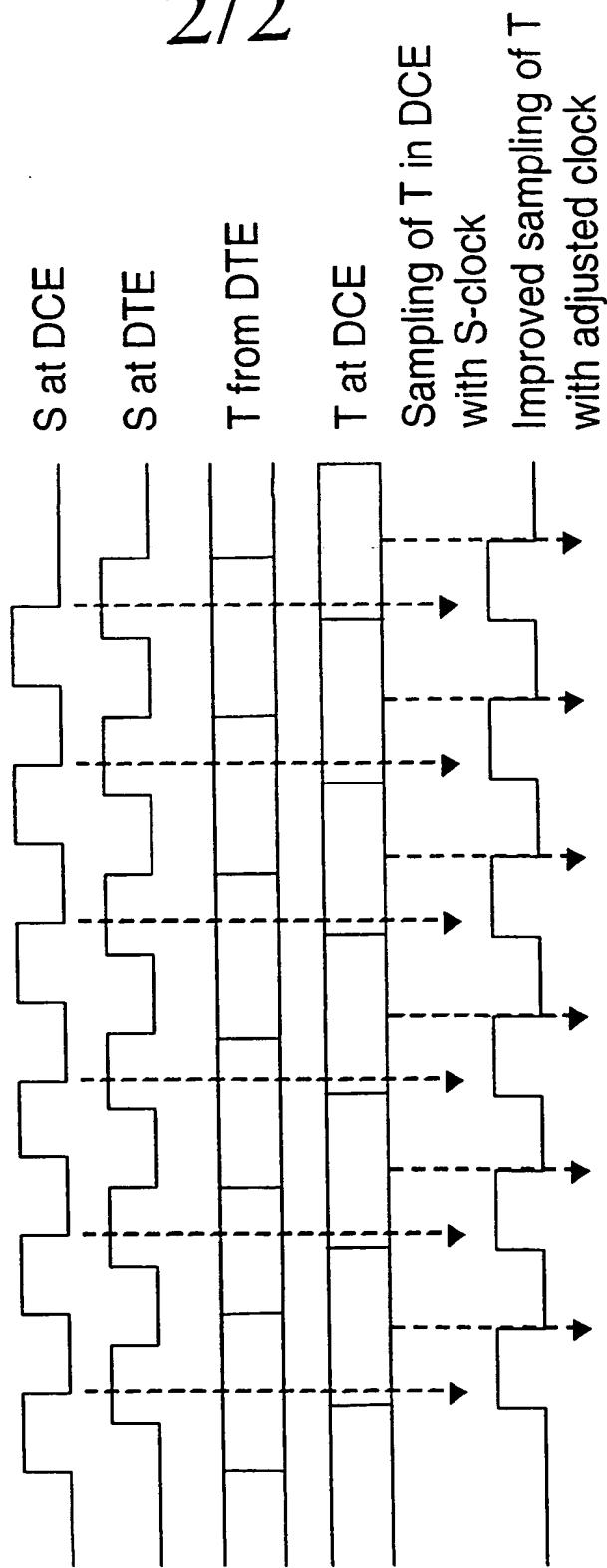


FIG. 1

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X.21 Interface (clock and data)

FIG. 2

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Article 36 and Rule 70)

Applicant's or agent's file reference  JGS/BF/133227	<b>FOR FURTHER ACTION</b>		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No.  PCT/NO99/00160	International filing date (day/month/year)  20/05/1999	Priority date (day/month/year)  25/05/1998	
International Patent Classification (IPC) or national classification and IPC H04L7/033			
Applicant  TELEFONAKTIEBOLAGET LM ERICSSON et al.			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 7 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I   <input checked="" type="checkbox"/> Basis of the report</li> <li>II   <input type="checkbox"/> Priority</li> <li>III   <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV   <input type="checkbox"/> Lack of unity of invention</li> <li>V   <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI   <input type="checkbox"/> Certain documents cited</li> <li>VII   <input checked="" type="checkbox"/> Certain defects in the international application</li> <li>VIII   <input checked="" type="checkbox"/> Certain observations on the international application</li> </ul>			

Date of submission of the demand  16/12/1999	Date of completion of this report  18.08.00
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Grimaldo, M Telephone No. +49 89 2399 7513



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/NO99/00160

**I. Basis of the report**

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

**Description, pages:**

1-6	as received on	29/06/2000 with letter of	20/06/2000
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**Claims, No.:**

1,2	as received on	29/06/2000 with letter of	20/06/2000
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**Drawings, sheets:**

1/2,2/2	as received on	29/06/2000 with letter of	20/06/2000
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2. The amendments have resulted in the cancellation of:

- the description,      pages:  
 the claims,      Nos.:  
 the drawings,      sheets:

3.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/NO99/00160

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims 1,2
	No:	Claims
Inventive step (IS)	Yes:	Claims
	No:	Claims 1,2
Industrial applicability (IA)	Yes:	Claims 1,2
	No:	Claims

**2. Citations and explanations**

**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/NO99/00160

**Documents cited**

Reference is made to the following documents:

D1: US 5115455 A  
D2: US 5566215 A  
D3: US 5568526 A  
D4: EP 0603600 A2  
D5: EP 0602898 A1  
D6: US 5245637 A  
D7: US 4916717 A

**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement**

1. Because of the serious clarity issues (see section VIII) of independent claim 1 its disclosure can be read into document D2.

Document D2, indeed, discloses a method for a clock delay compensation. The method uses a series of samples taken from a coded signal (a contra-directional signal) in order to correct the phase of a local clock (DCE clock) (column 2, lines 24-40 and abstract).

Document D2, however, differs from the method of claim 1 in that it does not explicitly disclose several details that are included in the subject-matter of claim 1. In particular document D2 does not explicitly mention any counter, any DCE and any DTE, that the signal transitions are used as reference for the resetting, that the data is always sampled in the middle of the symbols and that the delay is introduced by the cable.

However, although the several differences, none of them can be regarded as providing any special feature able to add an inventive step to the method of claim 1.

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/NO99/00160

These differences are merely details and their inclusion in the method of document D2 would be self-evident for a person skilled in the art on the basis of his common general knowledge.

The essence of the method disclosed by document D2, a compensation of a delay using a contra-directional signal, is exactly the same disclosed by claim 1.

Thus, the subject-matter of claim 1 does not involve an inventive step and claim 1 does not satisfy the criteria set forth in Article 33(1) and 33(3) PCT.

2. Dependent claim 2 do not seem to contain any feature which, in combination with the features of claim 1 on which it is dependent, would lead to a claim involving inventive activity (Article 33(3) of the PCT).

The subject-matter of claim 2 is indeed derivable from document D3 on column 2, lines 31-38.

3. The Applicant is of the opinion that document D2 differs from the method of claim 1 in that the method of document D2 is limited to a number of bits whereas his method can handle any delay. However this difference cannot be found in the formulation of any filed claim.

**VII. Certain defects in the international application**

1. The opportunity should have been also taken to correct a clerical error in the application: in claim 1 "data samling" should read "data sampling".

**VIII. Certain observations on the international application**

1. It is clear from the description on pages 1 and 2 that the following feature is essential to the definition of the invention:

- X.21 interface

Since independent claim 1 does not contain this feature it does not meet the

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/NO99/00160

requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.

2. The followings expressions used in claim 1 are vague and unclear and leave the reader in doubt as to the meaning of the technical features to which they refer, thereby rendering the definition of the subject-matter of said claim unclear (Article 6 PCT).
  - a) "signal element clock";  
it is not clear what this element is: a means or a signal, or a clock reference or something else?
  - b) "counter which controls the data sampling at the DCE with a signal element clock, a variable phase and a buffer";  
it is not clear if the signal element clock, the variable phase and the buffer belong to the DCE or to the DTE.
  - c) "transmitted data signals are delivered from the DTE with reference to the signal element clock signals";  
it is not clear if the transmitted data signals refer to some generic data transmitted by the DTE or to a specific data signals used as a reference to resetting the counter.

## METHOD RELATED TO CLOCK DELAY COMPENSATION

### Field of the invention

The present invention concerns a method related to clock delay compensation, especially related to connection of  
5 data communication equipment (DCE) to modems and other types of data transmission equipment (DTE).

The present invention also relates to data transmission interfaces.

More particularly, the present invention relates to a  
10 method as stated in the preamble of the enclosed patent claim 1.

### Background of the invention

#### THE PROBLEM AREA

For connection and data communication equipment (DCE) to  
15 modems and other types of data transmission equipment (DTE) there are standardised several interfaces. These interfaces define data and clocking as well as control lines. Typical interfaces mentioned are RS232 (V.24), V.35, V.36 and X.21. The electrical interfaces for the  
20 interface are defined in V.10, V.11 and V.28.

Basically, these interfaces were defined according to ITU rec. X21 which limits the bitrate to 64 kbit/s.

With use of the electrical interfaces V.11 ranges of several hundreds of meters of cable can be used. The interface V.35, V.36 and X.21 define this electrical interface  
25 for clock and date.

In connection with the use of this interface for bitrates higher than 64 kbit/s, by now up to 2 Mbit/s one problem

has arised, caused by the pulse delay on a long cable becoming comparable with the period of the clock.

In the case of a codirectional interface, that is clock and data have the same source, the delay is not a problem, but in the case where a contradirectional interface is used, like the X.21 interface or use of DCE-clock (114) on V.35/V.36, there will be a problem of detecting the data signal with the DCE-clock. This because the data signals have an arbitrarily unknown delay through the cable.

#### KNOWN SOLUTION

To overcome this problem, the DCEs are equipped with a manual option of changing the phase of the detecting clock, thus avoiding sampling of data close to the transitions. An extra not standardised X-circuit on the X.21 interface is also used.

#### PROBLEMS WITH KNOWN SOLUTIONS

Problems with known solutions are that the cable delay is unknown and the manual selection of inverted or not inverted clock is done on the respective site installation by trial. The X-circuit is not standardised and is by customers not recommended.

#### Further prior art

US 5 568 526 (Ferraiolo et al.) relates to a self-timed interface (STI) in which a clock signal clocks bit serial data onto a parallel, electrically conductive bus and the clock signal is transmitted on a separate line of the bus. The received data on each line of the bus is individually phase aligned with the clock signal. The received clock signal is used to define boundary edges of a data bit cell individually for each line, and the data on

each line of the bus is individually phase adjusted so that, for example, a data transition position is in the centre of the cell. Data are read into a buffer storage with the received clock and are read out with an internal  
5 clock in the interface.

EP 0 602 898-A1 (Kawada/Fujitsu Limited) relates to a method and apparatus for synchronising transmission of modem. The phase difference between internal and external data/clock signals are equalised, by controlling the in-  
10 ternal timing signal so that the measured phase differ-  
ence will approach a reference phase difference.

EP 0 603 600-A3 (Klimek et al./Siemens Rolm Communica-  
tions Inc.) relates to path delay compensation in an open-loop system, the signal paths being compensated by  
15 internal clocks in the units of the system. The compensa-  
tion is based on a synchronising signal.

US 4 916 717 (Sackman, III et al.) relates to clock syn-  
chronisation of a master clock following data messages received from a remote data transmitter having the same  
20 clock frequency, but which is phase shifted due to delays in the signal paths.

Further publications related to this technical field are NO patent applications 924247 (Coquerel/Institut Français du Pétrole), 942171 (Hedberg/Ericsson), 961421 (Buhr-  
25 gard/Ericsson) and 961454 (Buhrgard/Ericsson).

US 5 115 455 describes a method for stabilized data transmission. This invention only solves delay problems with clock and data signals in the same direction (DCE-DTE). It is not a general solution on the 103/T (X.21  
30 terminology) detection problem which includes detection in a contra-directional interface.

US 5 566 215 describes a method for restoring a clock signal by punctuating the transmission of the received signals. This is a known technology in signal detection. It depends on analysing a number of samples before resynchronizing, and is therefore said not to be instantaneous.

Objects of the invention

A main object of the present invention is to suggest a solution which automatically compensates for the cable delay and makes sure that data is always clocked in the middle of the symbol.

Another object of the present invention is to present a method wherein existing equipment is utilised in a far more expedite manner.

Still another object of the present invention is to provide a method by which time delay compensation is independent of the length of the transmission cable.

Brief summary of the invention

The above objects are achieved by a method as stated in the preamble, which according to the present invention is characterised by the features as stated in the characterising clause of the enclosed patent claim 1.

More specifically the present invention suggests to use the transition on the transmitted data (T-curcuit on X.21) as a reference for adjusting (resetting) a counter which controls the data sampling.

Further features and advantages of the present invention will appear from the following detailed description of embodiments, taken in conjunction with the enclosed drawings, as well as from the appending patent claims.

As for the feature characteristics of the invention, reference is made to the claims.

Disclosure of the drawings

Fig. 1 is a schematical diagram illustrating an example of  
5 a data transmission with related interfaces, wherein an embodiment of the present invention can be implemented.

Fig. 2 illustrates time diagrams related to transmitted data, signal element timing and received data, all in accordance with an appropriate embodiment of the present  
10 invention.

Detailed description of embodiments

With reference to Fig. 1 and Fig. 2 there will now in the following be described an example of how the method according to the present invention may be implemented.

15 As stated previously, the invention relates to a method which automatically compensates for the cable delay and makes sure that data is always clocked in the middle of the symbol.

The method uses the transition on the transmitted data  
20 (T-circuit on X.21) as a reference for adjusting (resetting) a counter which controls the data sampling.

The transmit data on the DCE-interface is delivered from the DTE with reference to the S-circuit (signal element timing) but with the mentioned cable delay. By clocking  
25 the data of the T-circuit into a buffer with the variable phase clock and clocking out with reference to the S-clock, error free operation is secured independent of delay.

## ADVANTAGES

The described invention makes it possible to use the X.21 interface for high bit-rates on long cables. Installation work and operational uncertainties are eliminated and  
5 standard X.21 can be used.

## BROADENING

The principle can be used for any synchronous interface with contra-directional timing.

P a t e n t   c l a i m s  
( a m e n d e d   2 0 . 0 6 . 0 0 )

1. Method for compensating a cable delay in transmitted data signals (5) which are sent through a cable (1) connecting data communication equipment (DCE) to data transmission equipment (DTE), the DCE including a counter which controls the data samling at the DCE with a signal element clock, a variable phase clock and a buffer, characterized in that the transmitted data signals (4) are delivered from the DTE with reference to the signal element clock signals including cable delay (3), and that the transitions (7) in the transmitted signal (5) on the DCE from the DTE, also including the cable delay, is used as a reference for resetting said counter for thereby ensuring that data always is sampled in the middle of the symbols of the transmitted signals (5) at the DCE.
2. Method as defined in claim 1, characterized in that the transmitted signals (4) in the DTE are clocked into said buffer with said variable phase clock, and are clocked out with reference to said signal element clock signals including cable delay (3).

1/2

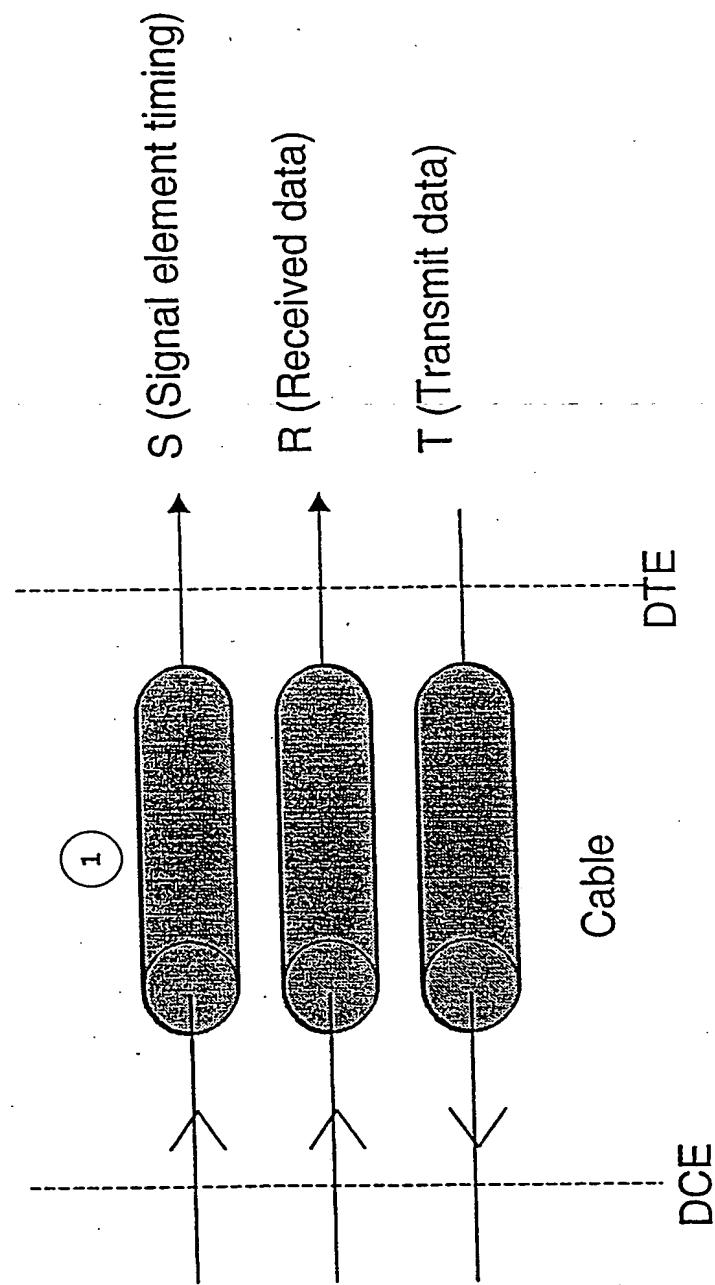


FIG. 1

2/2

X.21 Interface (clock and data)

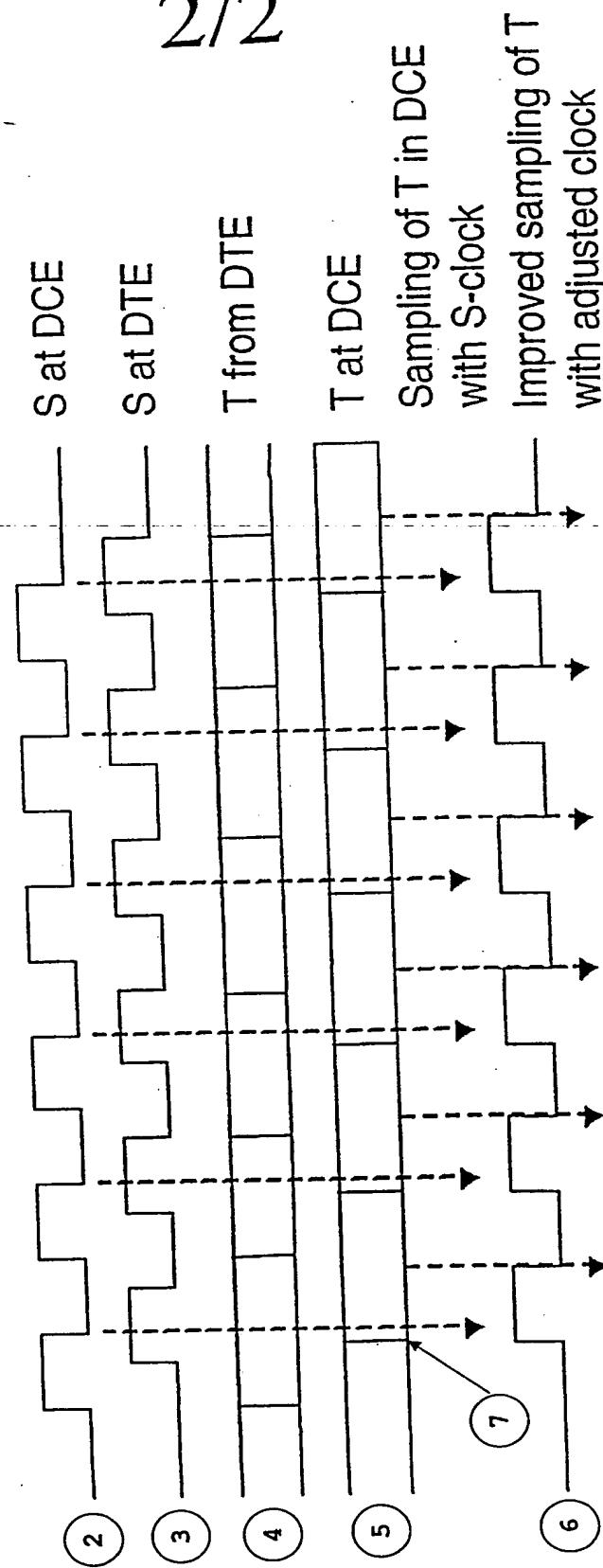


FIG. 2

AMENDED SHEET

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 99/00160

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0603600 A2 (ROLM COMPANY), 29 June 1994 (29.06.94), column 1, line 25 - line 32, claims 1-12, abstract	1-3
A	EP 0602898 A1 (FUJITSU LIMITED), 22 June 1994 (22.06.94), claims 1-13, abstract	1-3
A	US 5245637 A (JOHN E. GERSBACH), 14 Sept 1993 (14.09.93), column 2, line 44 - column 4, line 8, abstract	1-3
A	US 4916717 A (EDWARD J. SACKMAN, III ET AL), 10 April 1990 (10.04.90), abstract	1-3

## INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 99/00160

## A. CLASSIFICATION OF SUBJECT MATTER

**IPC6: H04L 7/033**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

**IPC6: H04L**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**SE,DK,FI,NO classes as above**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**WPI, EDOC**

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5115455 A (WILLIAM A. SAMARAS ET AL), 19 May 1992 (19.05.92), column 2, line 13 - column 3, line 13, claims 1-12, abstract --	1-3
X	US 5566215 A (PATRICK COQUEREL), 15 October 1996 (15.10.96), column 1, line 51 - column 2, line 67, claims 1-25, abstract --	1-3
A	US 5568526 A (FRANK D. FERRAIOLI ET AL), 22 October 1996 (22.10.96), column 1, line 59 - column 2, line 38; column 4, line 13 - column 6, line 16, abstract --	1-3

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Date of mailing of the international search report

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

28/09/99

International application No. PCT/NO 99/00160	
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 5115455 A	19/05/92	NONE		
US 5566215 A	15/10/96	CA 2082288 A		07/05/93
		DE 69226331 D,T		03/12/98
		EP 0541431 A,B		12/05/93
		FR 2683411 A,B		07/05/93
		NO 305340 B		10/05/99
US 5568526 A	22/10/96	CA 2150744 A		18/12/95
		EP 0687982 A		20/12/95
		JP 8044667 A		16/02/96
		US 5832047 A		03/11/98
EP 0603600 A2	29/06/94	US 5701334 A		23/12/97
EP 0602898 A1	22/06/94	DE 69325245 D		00/00/00
		JP 2871364 B		17/03/99
		JP 6188868 A		08/07/94
		US 5648993 A		15/07/97
US 5245637 A	14/09/93	NONE		
US 4916717 A	10/04/90	NONE		

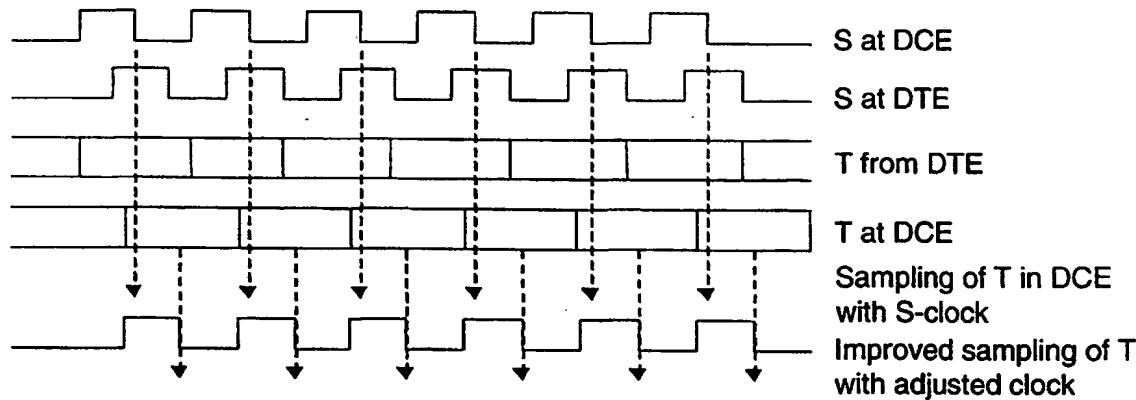


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> :  H04L 7/033		A3	(11) International Publication Number: <b>WO 99/62219</b>
			(43) International Publication Date: 2 December 1999 (02.12.99)
(21) International Application Number: PCT/NO99/00160		(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 20 May 1999 (20.05.99)			
(30) Priority Data: 19982361 25 May 1998 (25.05.98) NO			
(71) Applicant (for all designated States except US): TELEFONAK-TIEBOLAGET LM ERICSSON [SE/SE]; S-126 25 Stockholm (SE).			
(72) Inventor; and (75) Inventor/Applicant (for US only): SCHUMANN-OLSEN, Reidar [NO/NO]; Nøtteknekkeren 14, N-3400 Lier (NO).			
(74) Agent: OSLO PATENTKONTOR AS; Postboks 7007 M, N-0306 Oslo (NO).			
Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>			
(88) Date of publication of the international search report: 13 January 2000 (13.01.00)			

(54) Title: METHOD RELATED TO CLOCK DELAY COMPENSATION

## X.21 Interface (clock and data)



## (57) Abstract

The present invention concerns a method related to clock delay compensation, especially related to connection of data communication equipment (DCE) to modems and other types of data transmission equipment (DTE), the data signals having an arbitrarily delay through the cable in question, and the DCE comprising a detecting clock, and for the purpose of avoiding sampling of data close to the transitions, this problem is overcome by using the transition on the transmitted data (T-circuit on X.21) as a reference for adjusting (resetting) a counter which controls the data sampling, for thereby ensuring that data is always clocked in the middle of the symbol (data cell).

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## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/NO 99/00160

## A. CLASSIFICATION OF SUBJECT MATTER

**IPC6: H04L 7/033**

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## B. FIELDS SEARCHED

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Date of the actual completion of the international search

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Authorized officer  
**Johanna Lindqvist/mj**  
Telephone No. + 46 8 782 25 00

## INTERNATIONAL SEARCH REPORT

International application No. PCT/NO 99/00160
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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

28/09/99

International application No.

PCT/NO 99/00160

Patent document cited in search report	Publication date	Patent family member(s)			Publication date
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		US 5832047 A		03/11/98	
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		JP 6188868 A		08/07/94	
		US 5648993 A		15/07/97	
US 5245637 A	14/09/93	NONE			
US 4916717 A	10/04/90	NONE			

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1/2

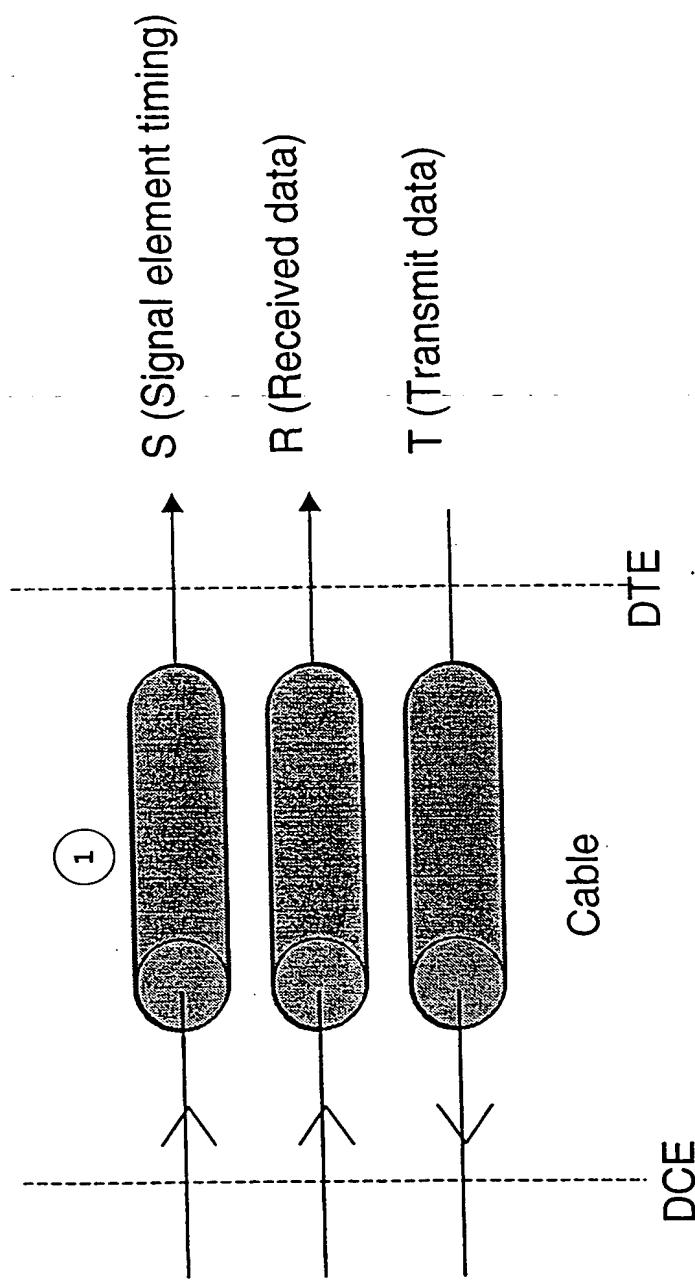
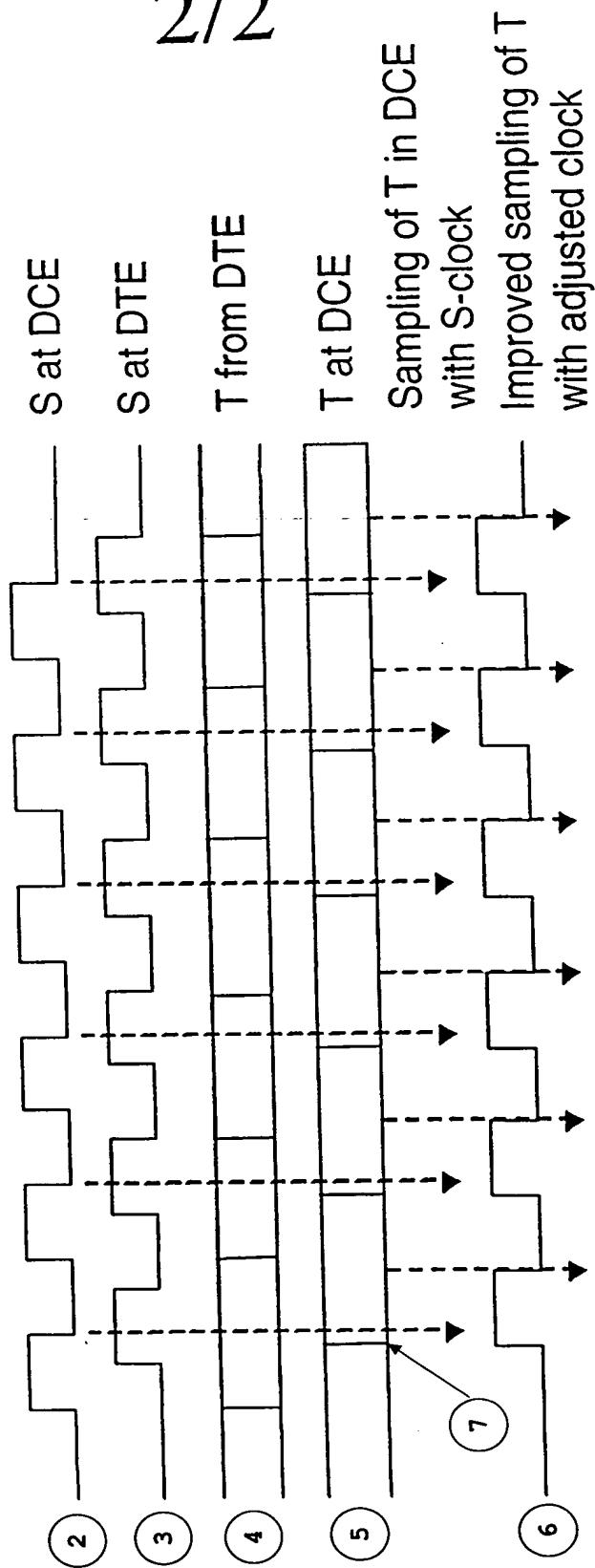


FIG. 1

2/2

X.21 Interface (clock and data)

FIG. 2

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

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<b>PCT/NO 99/00160</b>	
International Application No.	
20 MAI 1999 (20.05.99)	
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 <b>PATENTSTYRET</b> <small>Styrelsen for det industrielle rettsvært</small> ► PCT International application Name of receiving Office and "PCT International Application"	
Applicant's or agent's file reference <small>(if desired) (12 characters maximum)</small> JGS/BF/133227	

**Box No. I TITLE OF INVENTION**

Method related to clock delay compensation

**Box No. II APPLICANT**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

Telefonaktiebolaget LM Ericsson

S-126 25 STOCKHOLM, Sweden

This person is also inventor.

Telephone No.  
+46 8 719 00 00

Facsimile No.  
+46 8 719 30 91

Teleprinter No.

State (that is, country) of nationality:

SE

State (that is, country) of residence:

SE

This person is applicant  all designated States  all designated States except the United States of America  the United States of America only  the States indicated in the Supplemental Box

**Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

SCHUMANN-OLSEN, Reidar

Nøtteknekkeren 14

N-3400 LIER, Norway

This person is:

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Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1)  (25.05.98)  25 May 1998	19982361	Norway		Norway
item (2)				
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Figure of the drawings which should accompany the abstract:	Language of filing of the international application:	English
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POSTBOKS 7907 H, N-0306 OSLO

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1. Date of actual receipt of the purported international application:	20 MAI 1999 (20.05.99)	2. Drawings:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		<input checked="" type="checkbox"/> received:  <input type="checkbox"/> not received:
4. Date of timely receipt of the required corrections under PCT Article 1(2):		
5. International Searching Authority (if two or more are competent): ISA / SE	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.	

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

## PATENT COOPERATION TREATY

PCT

## NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

OSLO PATENTKONTOR AS  
Postboks 7007 M  
N-0306 Oslo  
NORVÈGE

Nr.	Y5-	O.Nr.
Mottatt		
10 DES. 1999		
Går til: S		

Date of mailing (day/month/year)  
02 December 1999 (02.12.99)

Applicant's or agent's file reference  
JGS/BF/133227

## IMPORTANT NOTICE

International application No. PCT/NO99/00160	International filing date (day/month/year) 20 May 1999 (20.05.99)	Priority date (day/month/year) 25 May 1998 (25.05.98)
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Applicant  
TELEFONAKTIEBOLAGET LM ERICSSON et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:  
AU,CN,EP,IL,JP,KP,KR,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:  
AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CU,CZ,DE,DK,EA,EE,ES,FI,GB,GD,GE,GH,GM,HR,  
HU, ID, IN, IS, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, OA, PL, PT, RO, RU,  
SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW  
The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).
3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 02 December 1999 (02.12.99) under No. WO 99/62219

## REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

## REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer

J. Zahra

Telephone No. (41-22) 338.83.38

Continuation of Form PCT/IB/308

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF  
THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

Date of mailing (day/month/year) 02 December 1999 (02.12.99)	<b>IMPORTANT NOTICE</b>
Applicant's or agent's file reference JGS/BF/133227	International application No. PCT/NO99/00160

The applicant is hereby notified that, at the time of establishment of this Notice, the time limit under Rule 46.1 for making amendments under Article 19 has not yet expired and the International Bureau had received neither such amendments nor a declaration that the applicant does not wish to make amendments.

## PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

INFORMATION CONCERNING ELECTED  
OFFICES NOTIFIED OF THEIR ELECTION

(PCT Rule 61.3)

To:		
OSLO PATENTKONTOR AS Postboks 7007 M Nr. 30 O.Nr.		
N-0306 Oslo NORVÈGE		Mottatt
		29 FEB. 2000
S Gar III:		

## Date of mailing (day/month/year)

14 February 2000 (14.02.00)

## Applicant's or agent's file reference

JGS/BF/133227

## IMPORTANT INFORMATION

## International application No.

PCT/NO99/00160

## International filing date (day/month/year)

20 May 1999 (20.05.99)

## Priority date (day/month/year)

25 May 1998 (25.05.98)

## Applicant

TELEFONAKTIEBOLAGET LM ERICSSON et al

1. The applicant is hereby informed that the International Bureau has, according to Article 31(7), notified each of the following Offices of its election:

AP :GH,GM,KE,LS,MW,SD,SL,SZ,UG,ZW

EP :AT,BE,CH,CY,DE,DK,ES,FI,FR,GB,GR,IE,IT,LU,MC,NL,PT,SE

National :AU,BG,BR,CA,CN,CZ,DE,IL,JP,KP,KR,MN,NO,NZ,PL,RO,RU,SE,SK,US

2. The following Offices have waived the requirement for the notification of their election; the notification will be sent to them by the International Bureau only upon their request:

EA :AM,AZ,BY,KG,KZ,MD,RU,TJ,TM

OA :BF,BJ,CF,CG,CI,CM,GA,GN,GW,ML,MR,NE,SN,TD,TG

National :AE,AL,AM,AT,AZ,BA,BB,BY,CH,CU,DK,EE,ES,FI,GB,GD,GE,GH,GM,HR,HU,

ID,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MD,MG,MK,MW,MX,PT,SD,SG,SI,SL,TJ,  
TM,TR,TT,UA,UG,UZ,VN,YU,ZA,ZW

3. The applicant is reminded that he must enter the "national phase" before the expiration of 30 months from the priority date before each of the Offices listed above. This must be done by paying the national fee(s) and furnishing, if prescribed, a translation of the international application (Article 39(1)(a)), as well as, where applicable, by furnishing a translation of any annexes of the international preliminary examination report (Article 36(3)(b) and Rule 74.1).

Some offices have fixed time limits expiring later than the above-mentioned time limit. For detailed information about the applicable time limits and the acts to be performed upon entry into the national phase before a particular Office, see Volume II of the PCT Applicant's Guide.

The entry into the European regional phase is postponed until 31 months from the priority date for all States designated for the purposes of obtaining a European patent.

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

## Authorized officer:

R. E. Staffel

Telephone No. (41-22) 338 63 36

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:  
**IPEA/ EPO**

# PCT

## CHAPTER II

### DEMAND

under Article 31 of the Patent Cooperation Treaty:  
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA		Date of receipt of DEMAND
<b>Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION</b>		Applicant's or agent's file reference <b>133227/ØS/BF</b>
International application No. <b>PCT/NO99/00160</b>	International filing date (day/month/year) <b>20.05.99</b>	(Earliest) Priority date (day/month/year) <b>(25.05.98)</b> <b>25 May 1998</b>
Title of invention <b>METHOD RELATED TO CLOCK DELAY COMPENSATION</b>		
<b>Box No. II APPLICANT(S)</b>		
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)  <b>Telefonaktiebolaget LM Ericsson</b> <b>S-126 25 STOCKHOLM, Sweden</b>		Telephone No.: <b>+46 8 719 00 00</b>  Facsimile No.: <b>+46 8 719 30 91</b>  Teleprinter No.:
State (that is, country) of nationality: <b>SE</b>	State (that is, country) of residence: <b>SE</b>	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)  <b>SCHUMANN-OLSEN, Reidar</b> <b>Nøtteknekkeren 14</b> <b>N-3400 LIER, Norway</b>		
State (that is, country) of nationality: <b>NO</b>	State (that is, country) of residence: <b>NO</b>	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)		
State (that is, country) of nationality:	State (that is, country) of residence:	
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.		

**Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The following person is  agent  common representative

and  has been appointed earlier and represents the applicant(s) also for international preliminary examination.

is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: (*Family name followed by given name; for a legal entity, full official designation.  
The address must include postal code and name of country.*)

Oslo Patentkontor AS  
P.O. Box 7007 M  
N-0306 Oslo, Norway

Telephone No.:

+47 22 44 38 67

Facsimile No.:

+47 22 55 30 88

Teleprinter No.:

Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent:

**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION**

## Statement concerning amendments:\*

1. The applicant wishes the international preliminary examination to start on the basis of:

the international application as originally filed  
 the description  as originally filed  
 as amended under Article 34

the claims  as originally filed  
 as amended under Article 19 (together with any accompanying statement)  
 as amended under Article 34

the drawings  as originally filed  
 as amended under Article 34

2.  The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3.  The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). (*This check-box may be marked only where the time limit under Article 19 has not yet expired.*)

- \* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

English

Language for the purposes of international preliminary examination: .....

which is the language in which the international application was filed.  
 which is the language of a translation furnished for the purposes of international search.  
 which is the language of publication of the international application.  
 which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

**Box No. V ELECTION OF STATES**

The applicant hereby elects all eligible States (*that is, all States which have been designated and which are bound by Chapter II of the PCT*)

excluding the following States which the applicant wishes not to elect:

## Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:			For International Preliminary Examining Authority use only	
	:	sheets	received	not received
1. translation of international application	:	sheets	<input type="checkbox"/>	<input type="checkbox"/>
2. amendments under Article 34	:	sheets	<input type="checkbox"/>	<input type="checkbox"/>
3. copy (or, where required, translation) of amendments under Article 19	:	sheets	<input type="checkbox"/>	<input type="checkbox"/>
4. copy (or, where required, translation) of statement under Article 19	:	sheets	<input type="checkbox"/>	<input type="checkbox"/>
5. letter	:	sheets	<input type="checkbox"/>	<input type="checkbox"/>
6. other (specify)	:	sheets	<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- |  |   |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet                             | 4. <input type="checkbox"/> statement explaining lack of signature                                  |
| 2. <input type="checkbox"/> separate signed power of attorney                            | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input type="checkbox"/> other (specify):  |

## Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

*Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).*


Ruth Fieldberg  
 Oslo Patentkontor AS  
 P.O. Box 7007 M  
 N-0306 Oslo, Norway

## For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:
2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):
3.  The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.  The applicant has been informed accordingly.
4.  The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.
5.  Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

## For International Bureau use only

Demand received from IPEA on:

# PATENT COOPERATION TREATY

From the:  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:  
OSLO PATENTKONTOR AS  
Postboks 7007 M  
N-0306 Oslo  
NORVEGE

Nr.	95	O.Nr.	
Mottatt			
20 MARS	2000		
Går til:	S		

PCT

WRITTEN OPINION

(PCT Rule 66)

Date of mailing  
(day/month/year)

16.03.00

REPLY DUE

within 3 month(s)  
from the above date of mailing

Applicant's or agent's file reference  
JGS/BF/133227

International application No.  
PCT/NO99/00160

International filing date (day/month/year)  
20/05/1999

Priority date (day/month/year)  
25/05/1998

International Patent Classification (IPC) or both national classification and IPC

H04L7/033

Applicant

TELEFONAKTIEBOLAGET LM ERICSSON et al.

1. This written opinion is the first drawn up by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

- I     Basis of the opinion
- II     Priority
- III     Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV     Lack of unity of invention
- V     Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI     Certain document cited
- VII     Certain defects in the international application
- VIII     Certain observations on the international application

3. The applicant is hereby invited to reply to this opinion.

**When?** See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

**How?** By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

**Also:** For an additional opportunity to submit amendments, see Rule 66.4. For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis. For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 25/09/2000.

Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer / Examiner  Grimaldo, M
--	--

Formalities officer (incl. extension of time limits)  Ahrens, R Telephone No. +49 89 2399 8136	
---	---

**I. Basis of the opinion**

1. This opinion has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed".*):

**Description, pages:**

1-5 as originally filed

**Claims, No.:**

1-3 as originally filed

**Drawings, sheets:**

1/2-2/2 as originally filed

2. The amendments have resulted in the cancellation of:

- the description,      pages:  
 the claims,      Nos.:  
 the drawings,      sheets:

3. This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims 1-3
Inventive step (IS)	Claims
Industrial applicability (IA)	Claims

**2. Citations and explanations**

**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**Cited documents**

The following documents are mentioned in the search report; the numbering will be adhered to in the rest of the procedure:

- D1: US 5115455 A
- D2: US 5566215 A
- D3: US 5568526 A
- D4: EP 0603600 A2
- D5: EP 0602898 A1
- D6: US 5245637 A
- D7: US 4916717 A

**V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement**

- 1a. Because of the vague, broad and unclear formulation (see also section VIII, paragraph 1) of independent claim 1 its disclosure can be read into document D1.

Document D1, indeed, discloses a method for a clock delay compensation for a data communication equipment (destination subsystem), modems and other types of data transmission equipment (source subsystem), the data signals having an arbitrarily delay through the cable (column 2, lines 13-20), and the DCE comprising a detecting clock characterised by using the transition on the transmitted data as a reference for adjusting a counter which controls the data sampling, for thereby ensuring that data is always clocked in the middle of the symbol (column 2, lines 38-48).

It is therefore considered that the subject-matter of independent claim 1 is already known from document D1 and the subject-matter of claim 1 lacks novelty in the sense of Article 33(1) and 33(2) PCT.

- 1b. Without going into details, it appears, furthermore, that the subject-matter of claim

1 is not new in respect of the disclosure of documents D2 or D3 (Article 33(1) and (2) PCT) see in particular abstract and column 2, lines 24-40 for document D2 and column 2, line 65 - column 3, line 4, abstract, column 4, lines 56-65 and column 6, lines 13-16 for document D3.

- 1c. It should be noted that even if the Applicant were to interpret claim 1 in such a manner as to enable him to allege that its subject-matter were novel, based on **minor differences** between the features of this claim and those disclosed in documents D1-D3, the subject-matter of claim 1 would still not involve an inventive step, Article 33(1) and 33(3) of the PCT, having regard to the disclosure of D1-D3.
2. Dependent claims 2 and 3 do not seem to contain any features which, in combination with the features of any of the claims on which they are dependent, would lead to a claim involving novelty (Article 33(2) of the PCT).

The subject-matter of claim 2 is indeed derivable from document D2 on column 1, line 66, column 3, line 5 and the subject-matter of claim 3 is derivable from document D3 on column 2, lines 31-38.

3. It is not at present apparent which part of the application could serve as basis for a new, claim which would satisfy the criteria set fort Article 33(1) PCT. Should the Applicant nevertheless regard some particular matter as patentable an independent claim including such particular matter should be filled, taking account of Rule 6.3(b) PCT. The Applicant should also indicate in the letter of reply the difference vis-à-vis the state of the art and the inventive significance thereof.

## **VII. Certain defects in the international application**

1. To meet the requirements of Rule 6.3(b) PCT, the independent claims should be properly cast in the two-part form, with those features which in combination are

part of the prior art (see documents D1 or D2 or D3), being placed in the preamble.

2. To meet the requirements of Rule 5.1(a)(ii) PCT, documents D1 and D2 should be identified in the description and the relevant background art disclosed therein should be briefly discussed.
3. Reference signs in parentheses should be inserted in the claims to increase their intelligibility, Rule 6.2(b) PCT. This applies to both the preamble and characterising portion.
4. In order to fulfil the requirements of Rule 5.1(a)(iii) PCT, the description should be brought into conformity with the new claims.
5. The Applicant is requested to file amendments by way of replacement pages. He should also take into account the requirements of Rule 66.8 PCT. In particular, fair copies of the amendments should preferably be filed in triplicate.
6. The attention of the Applicant is however drawn to the fact that the application may not be amended in such a way that it contains subject-matter which extends beyond the content of the application as filed, Article 34(2)(b) PCT.  
In order to facilitate the examination of the conformity of the amended application with the requirements of Article 34(2)(b) PCT, the Applicant is requested to clearly identify the amendments carried out, irrespective of whether they concern amendments by addition, replacement or deletion, and to indicate the passages of the application as filed on which these amendments are based.  
If the Applicant regards it as appropriate these indications could be submitted in handwritten form on a copy of the relevant parts of the application as filed.

**VIII. Certain observations on the international application**

1. Claim 1 does not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The claim attempts to define the subject-matter in terms of the **result to be achieved** which merely amounts to a statement of the underlying problem. The technical features necessary for achieving this result should be added.
  
2. The relative terms "especially related..." used in claim 1 has no well-recognised meaning and leaves the reader in doubt as to the meaning of the technical features to which it refers, thereby rendering the definition of the subject-matter of said claim unclear (Article 6 PCT).
  
3. The terms "cable in question..." used in claim 1 leaves the reader in doubt as to the meaning of the technical features to which it refers, thereby rendering the definition of the subject-matter of said claim unclear (Article 6 PCT).
  
4. The use of brackets around expressions that do not include reference signs give rise to a lack of clarity because it is unclear whether the expressions in brackets limit the features to which they refer (Article 6 PCT, Guidelines, section IV, III-4.11).  
As a consequence expressions like "(T-circuit on X.21)" or "(resetting)" or "(data cell)" in claim 1, "(S-circuit)" in claim 2, and "(S-clock)" in claim 3, should be amended.



09/700970

532 Rec'd PCT/PTO 20 NOV 2000

**OSLO PATENTKONTOR AS**

European Patent Office  
IPEA  
D-80298 Munich  
Tyskland

LORENTZ SELMER\*  
FREDRIK WILH. MEYN\*  
PER A. MARTINSEN\*  
TROND GUSTAD\*  
HENRIK JUEL PETTERSEN\*  
TONE TANGEVALD-JENSEN\*  
CLAUS CHR. SCHMIDT  
ANNE NÆVESTAD  
ØYVIND SMEDSENG  
RITA SANDNES

Attn: Mr. M. Grimaldo

\* Members of the  
Association of  
Norwegian  
Patent Agents



**Your ref:**  
-/

**Our ref:**  
EC/hmm/133227

**Oslo,**  
20. June 2000

**Re: INTERNATIONAL PATENT APPLICATION NO. PCT/NO99/00160**  
**TELEFONAKTIEBOLAGET LM ERICSSON**

Reference is made to the Written Opinion of 16.03.00 for International application No. PCT/NO99/00160 received 20.03.00. This reply exceeds the time limit as previously informed in the telefax sent to you on 16.06.00, and in the telephone call with Miss Ahrens.

Enclosed is an amended sheet including amended claims and some other changes in the application. The amendments are:

- Elements from the documents in the search report of the written opinion is being placed in the preamble of claim 1
- Reference numerals are added to the claims and the corresponding figures
- Claim 1 is brought into a clearer formulation
- Former claim 2 is included in claim 1
- Some terms and expressions pointed out in the written opinion are removed or replaced
- Documents D1 and D2 are identified in the background art
- The description is brought into conformity with the amended claims

In collaboration with the inventor, we have developed the following counter-arguments regarding the novelty of the invention relative to the cited documents in the Written Opinion:

**D1: US 5.115.455**

The summary of the invention in D1 states: "...data transmitted in a synchronous system from a source subsystem remains stable at the input of a state device in the destination subsystem long enough to meet the setup and hold time of the requirements of the state device even if the clock skew plus the propagation delays which exceeds the clock cycle time of the subsystems." This is obtained by forwarding the clock through a delay device which shifts the clock



one half clock cycle. This invention describes a co-directional interface with the clock and data in the same direction (DCE-DTE). In modem interface, this is equivalent to the use of clock 114 in X.21 interface for detection of data on circuit 104 in X.21 interface. For this detection, the cable delay creates no problem since delay of both signals are the same. In other words, the invention described in D1 is of no interest. The invention in PCT/NO99/00160 describes the problem and solution of data detection in a contra-directional interface (look-back timing), where the data from DTE (103/T in X.21 interface) is transmitted with the DCE clock (114/S in X.21 interface) delivered through the cable delay from DCE. The application is a general solution to the 103/T detection problem in the DCE and the solution can compensate for any delay.

#### D2: US 5.566.215

This patent describes a method for the restoring of a clock signal from a coded signal sent on a transmission channel. As to our experience, this describes a known technology far from the idea of the invention in PCT/NO99/00160. PCT/NO99/00160 describes a solution on a signal detection where there is a known clock signal (114/S in X.21 interface) which is used as a basis for the detection of an incoming synchronous data signal (103/T in X.21 interface) causing an unknown delay related to the clock. A variable phase clock synchronized to the clock 114/S in X.21 interface is used for data detection. The phase reference is the transition of the NRZ data 103/T in X.21 interface. This method, unlike the one in D2, is not limited to a number of bits, but can handle any delay.

#### D3: US 5.568.526

This invention also describes a solution on a co-directional problem, a databus and clock distributed in an apparatus bus system. Summary of invention column 2 line 35-40: "A controller formats data into packets for byte parallel, bit serial, transmission along with headers specifically coded to provide unique data patterns that allow for correction of skew up to three bit cells in addition to initial phase adjustment." This method can not be used to solve the DCE/DTE delay problem described in PCT/NO99/00160. Also, it suffers with delay handling limitations (three bits).

For the documents D4-D7, the same comments as given to D1-D3 are valid.

Yours very truly,

Espen Christensen

Encl: Amended specification, claims and figures

**METHOD RELATED TO CLOCK DELAY COMPENSATION**Field of the invention

The present invention concerns a method related to clock delay compensation, especially related to connection of  
5 data communication equipment (DCE) to modems and other types of data transmission equipment (DTE).

The present invention also relates to data transmission interfaces.

More particularly, the present invention relates to a  
10 method as stated in the preamble of the enclosed patent claim 1.

Background of the invention**THE PROBLEM AREA**

For connection and data communication equipment (DCE) to  
15 modems and other types of data transmission equipment (DTE) there are standardised several interfaces. These interfaces define data and clocking as well as control lines. Typical interfaces mentioned are RS232 (V.24), V.35, V.36 and X.21. The electrical interfaces for the  
20 interface are defined in V.10, V.11 and V.28.

Basically, these interfaces were defined according to ITU rec. X21 which limits the bitrate to 64 kbit/s.

With use of the electrical interfaces V.11 ranges of several hundreds of meters of cable can be used. The interface V.35, V.36 and X.21 define this electrical interface  
25 for clock and date.

In connection with the use of this interface for bitrates higher than 64 kbit/s, by now up to 2 Mbit/s one problem

has arised, caused by the pulse delay on a long cable becoming comparable with the period of the clock.

In the case of a codirectional interface, that is clock and data have the same source, the delay is not a problem, but in the case where a contradirectional interface is used, like the X.21 interface or use of DCE-clock (114) on V.35/V.36, there will be a problem of detecting the data signal with the DCE-clock. This because the data signals have an arbitrarily unknown delay through the cable.

#### KNOWN SOLUTION

To overcome this problem, the DCEs are equipped with a manual option of changing the phase of the detecting clock, thus avoiding sampling of data close to the transitions. An extra not standardised X-circuit on the X.21 interface is also used.

#### PROBLEMS WITH KNOWN SOLUTIONS

Problems with known solutions are that the cable delay is unknown and the manual selection of inverted or not inverted clock is done on the respective site installation by trial. The X-circuit is not standardised and is by customers not recommended.

#### Further prior art

US 5 568 526 (Ferraiolo et al.) relates to a self-timed interface (STI) in which a clock signal clocks bit serial data onto a parallel, electrically conductive bus and the clock signal is transmitted on a separate line of the bus. The received data on each line of the bus is individually phase aligned with the clock signal. The received clock signal is used to define boundary edges of a data bit cell individually for each line, and the data on

each line of the bus is individually phase adjusted so that, for example, a data transition position is in the centre of the cell. Data are read into a buffer storage with the received clock and are read out with an internal  
5 clock in the interface.

EP 0 602 898-A1 (Kawada/Fujitsu Limited) relates to a method and apparatus for synchronising transmission of modem. The phase difference between internal and external data/clock signals are equalised, by controlling the in-  
10 ternal timing signal so that the measured phase differ-  
ence will approach a reference phase difference.

EP 0 603 600-A3 (Klimek et al./Siemens Rolm Communica-  
tions Inc.) relates to path delay compensation in an open-loop system, the signal paths being compensated by  
15 internal clocks in the units of the system. The compensa-  
tion is based on a synchronising signal.

US 4 916 717 (Sackman, III et al.) relates to clock syn-  
chronisation of a master clock following data messages received from a remote data transmitter having the same  
20 clock frequency, but which is phase shifted due to delays in the signal paths.

Further publications related to this technical field are  
NO patent applications 924247 (Coquerel/Institut Français du Pétrole), 942171 (Hedberg/Ericsson), 961421 (Buhr-  
25 gard/Ericsson) and 961454 (Buhrgard/Ericsson).

US 5 115 455 describes a method for stabilized data transmission. This invention only solves delay problems with clock and data signals in the same direction (DCE-DTE). It is not a general solution on the 103/T (X.21  
30 terminology) detection problem which includes detection in a contra-directional interface.

US 5 566 215 describes a method for restoring a clock signal by punctuating the transmission of the received signals. This is a known technology in signal detection. It depends on analysing a number of samples before resynchronizing, and is therefore said not to be instantaneous.

Objects of the invention

A main object of the present invention is to suggest a solution which automatically compensates for the cable delay and makes sure that data is always clocked in the middle of the symbol.

Another object of the present invention is to present a method wherein existing equipment is utilised in a far more expedite manner.

Still another object of the present invention is to provide a method by which time delay compensation is independent of the length of the transmission cable.

Brief summary of the invention

The above objects are achieved by a method as stated in the preamble, which according to the present invention is characterised by the features as stated in the characterising clause of the enclosed patent claim 1.

More specifically the present invention suggests to use the transition on the transmitted data (T-circuit on X.21) as a reference for adjusting (resetting) a counter which controls the data sampling.

Further features and advantages of the present invention will appear from the following detailed description of embodiments, taken in conjunction with the enclosed drawings, as well as from the appending patent claims.

As for the feature characteristics of the invention, reference is made to the claims.

Disclosure of the drawings

Fig. 1 is a schematical diagram illustrated an example of  
5 a data transmission with related interfaces, wherein an embodiment of the present invention can be implemented.

Fig. 2 illustrates time diagrams related to transmitted data, signal element timing and received data, all in accordance with an appropriate embodiment of the present  
10 invention.

Detailed description of embodiments

With reference to Fig. 1 and Fig. 2 there will now in the following be described an example of how the method according to the present invention may be implemented.

- 15 As stated previously, the invention relates to a method which automatically compensates for the cable delay and makes sure that data is always clocked in the middle of the symbol.  
The method uses the transition on the transmitted data  
20 (T-circuit on X.21) as a reference for adjusting (resetting) a counter which controls the data sampling.

The transmit data on the DCE-interface is delivered from the DTE with reference to the S-circuit (signal element timing) but with the mentioned cable delay. By clocking  
25 the data of the T-circuit into a buffer with the variable phase clock and clocking out with reference to the S-clock, error free operation is secured independent of delay.

## ADVANTAGES

The described invention makes it possible to use the X.21 interface for high bit-rates on long cables. Installation work and operational uncertainties are eliminated and  
5 standard X.21 can be used.

## BROADENING

The principle can be used for any synchronous interface with contra-directional timing.

P a t e n t   c l a i m s  
( a m e n d e d   2 0 . 0 6 . 0 0 )

1. Method for compensating a cable delay in transmitted data signals (5) which are sent through a cable (1) connecting data communication equipment (DCE) to data transmission equipment (DTE), the DCE including a counter which controls the data samling at the DCE with a signal element clock, a variable phase clock and a buffer, characterized in that the transmitted data signals (4) are delivered from the DTE with reference to the signal element clock signals including cable delay (3), and that the transitions (7) in the transmitted signal (5) on the DCE from the DTE, also including the cable delay, is used as a reference for resetting said counter for thereby ensuring that data always is sampled in the middle of the symbols of the transmitted signals (5) at the DCE.
2. Method as defined in claim 1, characterized in that the transmitted signals (4) in the DTE are clocked into said buffer with said variable phase clock, and are clocked out with reference to said signal element clock signals including cable delay (3).

**A b s t r a c t**

The present invention concerns a method relates to clock delay compensation, especially related to connection of data communication equipment (DCE) to modems and other  
5 types of data transmission equipment (DTE), the data signals having an arbitrarily delay through the cable in question, and the DCE comprising a detecting clock, and for the purpose of avoiding sampling of data close to the transitions, this problem is overcome by using the transition 10 on the transmitted data (T-curcuit on X.21) as a reference for adjusting (resetting) a counter which controls the data sampling, for thereby ensuring that data is always clocked in the middle of the symbol (data cell).

15 Fig. 2

1/2

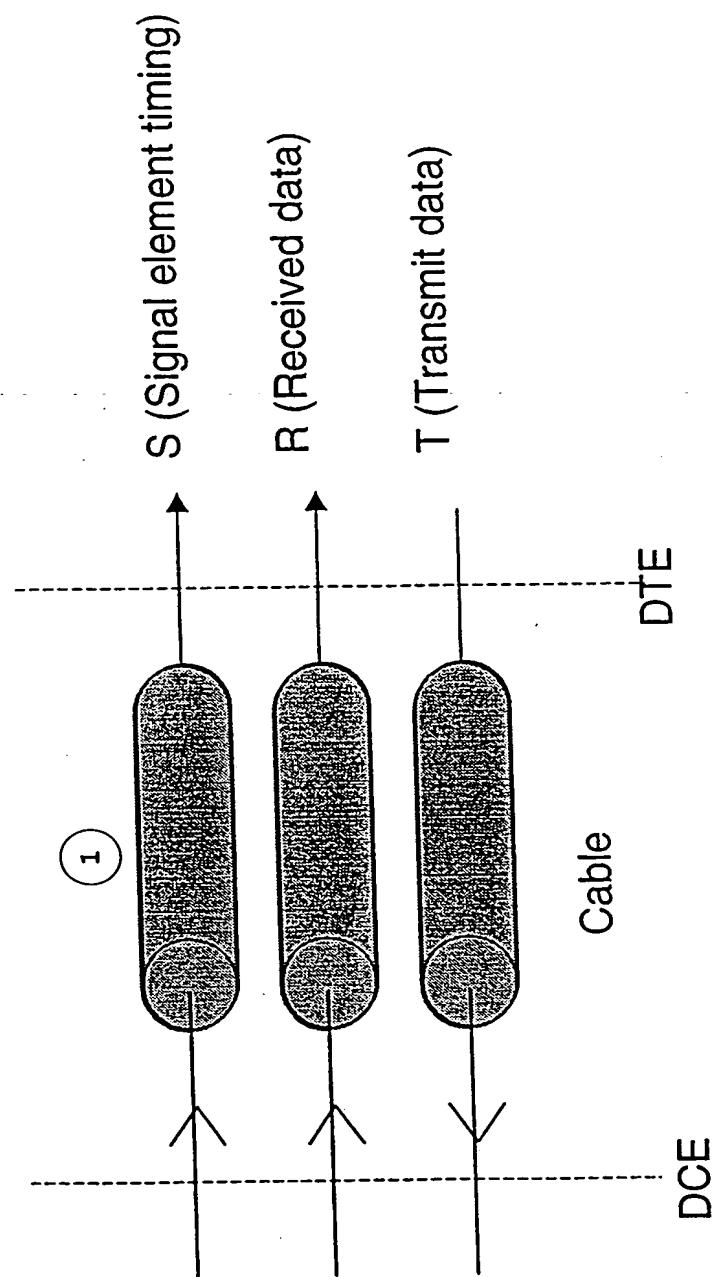
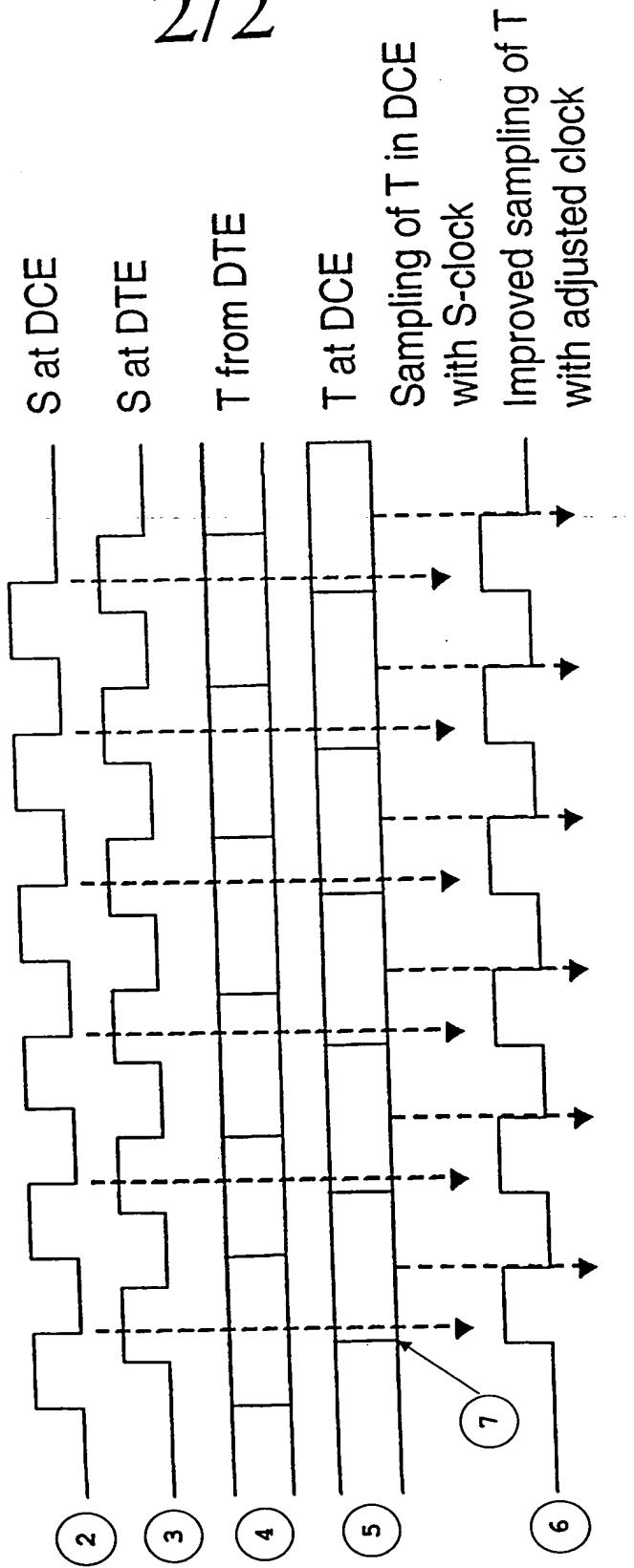


FIG. 1

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X.21 Interface (clock and data)

FIG. 2

## PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

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## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

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Date of mailing (day/month/year) 14 February 2000 (14.02.00)	
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Applicant SCHUMANN-OLSEN, Reidar	

1. The designated Office is hereby notified of its election made:

 in the demand filed with the International Preliminary Examining Authority on:

16 December 1999 (16.12.99)

 in a notice effecting later election filed with the International Bureau on:2. The election  was was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

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